European Green Capital Award

2025

Brescia application

Indicator 2

2. Water

2.A Present Situation

Please complete the following table providing the most recent data that is available:

Table 1: Benchmarking Data – Water

∗ For EGL applicants the following applies: when the applicant cannot provide certain benchmark data, a brief description of the current situation regarding drinking water, wastewater and surface and ground water bodies must be provided.

Indicator		Unit	Year of Data
Drinking water			
Drinking water consumption	**223**	Litres/capita/day	**2022**
Proportion of water losses from the distribution network	**27.9% (*)**	Infrastructure leakage index ILI, or (revenue volume (on invoices)) / supplied volume) * 100	**2022**
Wastewater			
Number and capacity of urban waste water treatment plants (UWWTP)	**296'000 inh**	No. , population equivalents	**2022**
Treatment level which is applied in each UWWTP: primary, secondary or more stringent	**Advanced tertiary: two CAS lines (Conventional Activated Sludge) and one MBR (Membrane Biological Reactor) line, each with phosphorus and nitrogen removal. Disinfection achieved by MBR flow (50%) with CAS flows (25% + 25%)**	Treatment level	**2022**
Proportion of population connected to the waste water collecting system and treatment plant(s)	**95.65**	%	**2022**
Number of times sewer overflows occur per year	**13**	No. of times sewer overflows per year	**2022**
Surface and ground water bodies			
Ecological status of surface water bodies identified under the Water Framework Directive (WFD)	**Mella River: poor Garza torrent: sufficient (Figure 3)**	Status	**2019**
Ecological status of groundwater bodies identified under the WFD	**Surface: good Intermediate: not good Deep: not good**	Status	**2019**
Classification of existing bathing sites according to requirements of the Bathing Water Directive (excellent/good/sufficient/poor)	---	Classification	---

(*) Percentage of water losses calculated according to the indications of the Regulatory Authority for Energy Networks and Environment (ARERA) **[1]**

Please elaborate on the benchmarking data entered in the table above. Please provide the following information:

Drinking water:

1. To what extent the requirements of the EU Drinking Water Directive (DWD, 98/83/EC) are met. If the parametric value of a parameter set out in the Annex I, part A and B of the EU DWD 98/83/EC was exceeded, indicate for this parameter the ratio of non-compliance i.e. the number of exceedances versus the total number of samples taken.
2. A breakdown over the last 3 years of the drinking water consumption for the different sectors (households, industry, agriculture, etc.).
3. Source of drinking water - refer to aquifers and river basin management. Also refer to non-conventional resources and water recycling initiatives.

Wastewater:

4. To what extent the requirements of the EU Urban Waste Water Treatment Directive (UWWTD, 91/271/EEC) are met (collection and treatment). Also mention any additional treatment steps beyond requirements of the UWWTD 91/271/EEC.
5. Explanation of the type of treatment applied to fraction of wastewater that is not connected to the waste water collecting systems (individual or other appropriate systems).
6. Beyond the current UWWTD, but in line with the proposal for a revised UWWTD, list any energy efficiency or energy production measures
7. Beyond the current UWWTD, but in line with the proposal for a revised UWWTD, list any measures for the reduction of greenhouse gas emissions

(max. 1000 words and five graphics, images or tables)

The very first records of the Brescia aqueduct date back to the first century AD. In 1908, the Municipality of Brescia established the *Azienda speciale dei Servizi Municipalizzati (A.S.M.),* which has managed the municipal aqueduct since 1933.

Currently the company A2A - Ciclo Idrico performs the management service of the integrated water service for the Municipality of Brescia. The service includes the management of the municipal aqueduct and the sewerage system with related purification treatment.

Aqueduct

The Brescia water supply network (705 km) is equipped with compensation and reserve tanks with a storage volume of 29'000 m³ and a production capacity of 120'000 m^3/day. This is guaranteed by 41 wells tapping mainly in the deep groundwater and from 3 sources (The Mompiano source and the two Cogozzo sources).

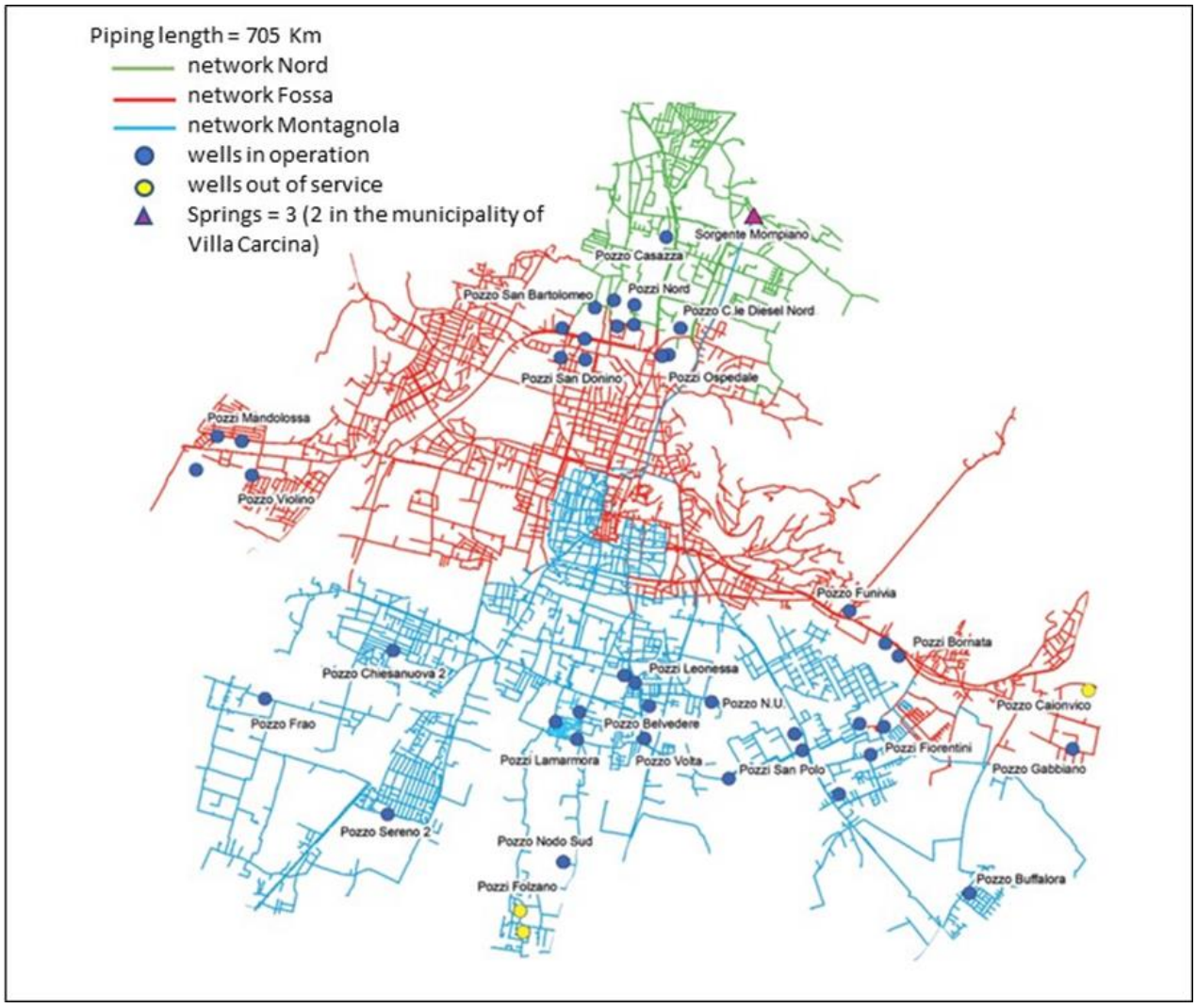

***Figure 1**: Water supply network of the Municipality of Brescia*

Drinking water consumption

The water supply network provides for a consumption of about 16.3 million m^3 per year, divided into the four types shown in the following table:

Water consumption in m^3			
	2020	2021	2022 (*)
Civil and domestic use *(households)*	12.884.384	12.421.328	12.355.577
Civil and non-domestic use *(public places and offices)*	1.444.356	1.123.228	1.117.282
Agricultural and zootechnical use	16.519	17.851	17.756
Industrial use, other productive activities, other	2.150.113	2.817.266	2.802.353
Total	**16.495.372**	**16.379.673**	**16.292.968**

***Table 1**: Brescia water consumption over the last 3 years*

Drinking water quality

The quality of distributed water meets the requirements of the EU Drinking Water Directive (EU) 2020/2184.

To guarantee that the national legislation (Legislative Decree 31/01) quality standards for water intended for human consumption are respected at all water supply points, regular checks are carried out by ***A2A - Ciclo Idrico*** and by the *Azienda Territoriale Sanitaria (ATS).*

In 2022, the following results are noted:

- Number of checks conducted: 381
- Number of parameters investigated: 14'496
- Percentage of drinking eligibility: 100%

Observatory Acqua Bene Comune

In 2015, a fervent discussion started in Brescia concerning the quality of water distributed by the municipal aqueduct, with a focus on the parameter Hexavalent Chromium (Cr VI). The intensification of the debate was not caused by a deterioration of the quality of distributed water, on the contrary, by an increased sensitivity of the citizens towards this issue.

The various points of view concerning this topic, the complexity in the access to the data from inspections, as well as the need to start an effective public discussion on the issue, led the municipal administration to establish the Observatory '*Acqua Bene Comune'* (Figure 2).

Figure 2*: Acqua Bene Comune* Observatory

The Municipal Administration, in accordance with the Observatory and ***A2A – Ciclo Idrico,*** launched the "Chromium free" action. Even though the CrVI was present in a lower concentration than the legal limit of 50 µg/l, the project (2014-2018) resulted in the installation of CrVI removal plants in 27 wells, self-imposing a maximum limit of 2 µg/l.

The activity carried out over the years and was monitored within the Observatory.The data and interventions on CrVI are reported in the documents drafted by the Observatory and reported on the web page of the municipality of Brescia. **[2]**

In addition, it was launched in 2019, WatShop, a science shop project coordinated by the University of Brescia to foster collaboration between civil society, public and private research organizations and companies in the area of appropriate and intelligent management of water resources in a changing climate. **[3]**

Other dissemination activities promoting the appropriate use of water:

- installation of public water points (12 water kiosks distributing cold sparkling and natural water)
- distribution of re-usable water bottles in municipal elementary schools and to first-year students at the University of Brescia
- activation of a website by the water provider, devoted to the main water quality data for the points of interest. The webpage can also be reached by scanning a Qr-Code placed at municipal drinking fountains.

Water losses

In 2020, the index of total water losses in the Municipality of Brescia (defined by ARERA in resolution 917/2017), **[1]** is 27.9%.

These losses decreased from 2018 to 2020 by around two percentage points as a result of the successful modernization of the aqueduct network implemented by A2A (2017 “crash program").

The streams in Brescia

The state assessment of surface waters is presented in the document of the Regional Agency for Environmental Protection (ARPA Lombardy) ***“Stato delle acque superficiali Bacino del Fiume Oglio Rapporto sessennale 2014-2019 September 2022”*** **[4]** (Figure 3).

Groundwater in Brescia

The state assessment of groundwater is presented in the document of ARPA Lombardy ***“Stato delle acque sotterranee in Regione Lombardia Rapporto sessennale 2014-2019 - Giugno 2021”*** **[5]**. The classification in terms of the 3 types of groundwater classified by ARPA Lombardy as surface, intermediate and groundwater (Figure 3).

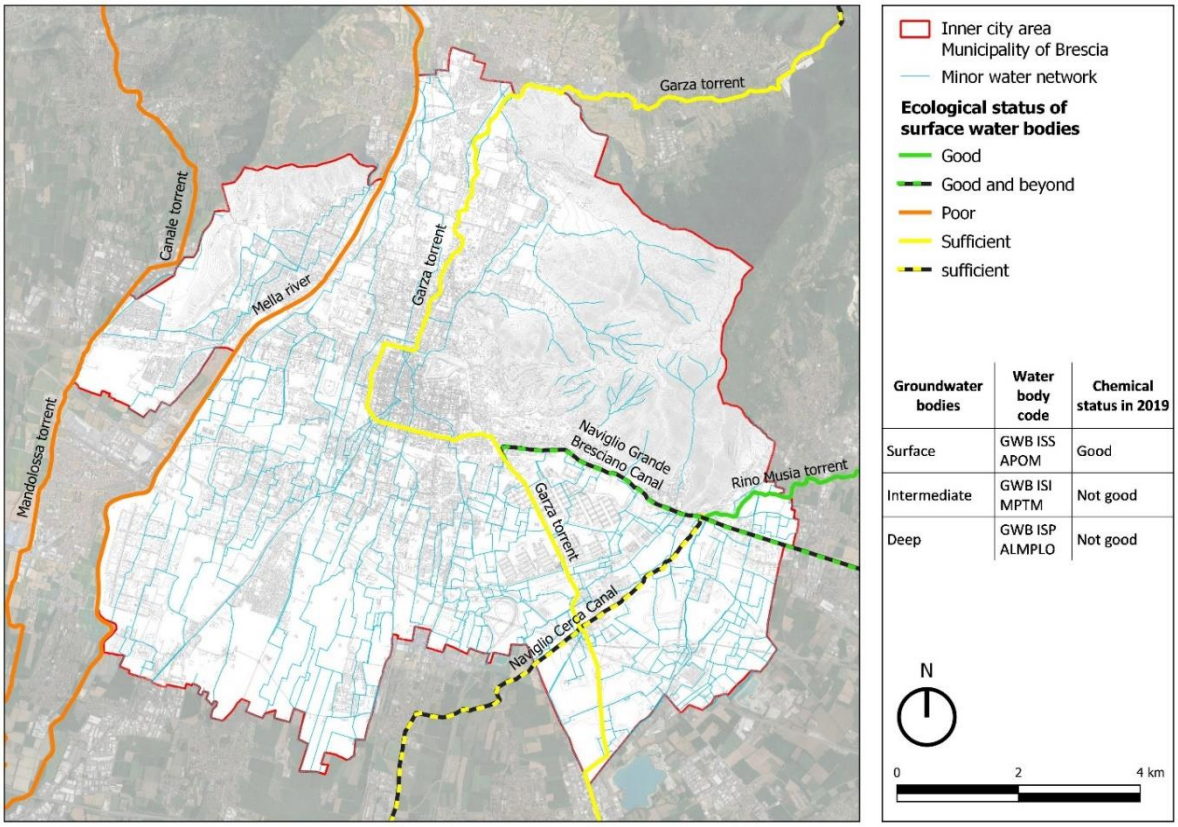

***Figure 3**: Surface and groundwater quality*

Wastewater

Concerning wastewater, the city of Brescia is served by the Verziano waste treatment plant. It has a capacity of 296'000 inh **[6]** and treats sewage from some neighboring municipalities.

The plant consists of three treatment lines operating in tandem and a sludge line, fully fulfilling the requirements imposed by the EU Urban Waste Water Directive (UWWTD, 91/271/EEC) and the related national legislation (D.L.vo n. 152/2006).

The treatment/reduction rates for each parameter are:

- BOD_5 = 96.8%
- COD = 94.7 %
- Total suspended solids = 99.0 %
- Nitrogen= 81.2 %
- Phosphorus = 89.1 %

These performance levels are made possible by the advanced tertiary treatment, which in all three lines includes secondary treatment as well as a specific treatment for Nitrogen and Phosphorus. In particular, in the largest line, treating 50 per cent of the water load, there is an ultrafiltration compartment.

The treatment plant is equipped with the anaerobic treatment of excess sludge and dewatering.

In addition, the sludge in output from the plant is delivered to waste-to-energy plants to produce electricity and hot water in order to supply the district heating network throughout the city.

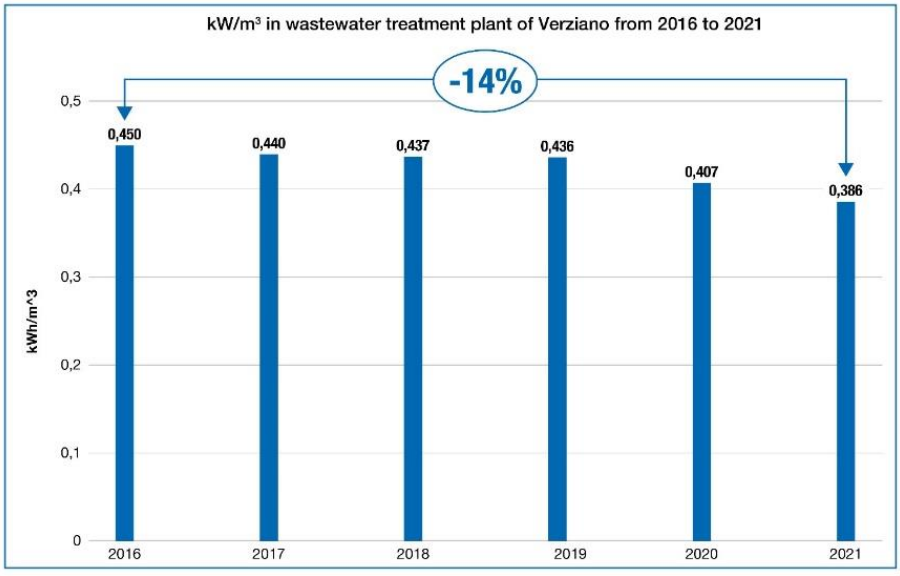

***Figura 4**: reduction of energy consumption in the wastewater treatment plant of Verziano.*

The management of the plant has always been directed toward the optimization of consumption and the production of electricity from renewable sources intended for self-consumption. **[7].**

2.B Past Performance

The aim of this section is to make clear how the situation described in the previous section has been achieved in the past ten years. Please provide the following information:

1. Trends on/changes in:

   Drinking water:

   a. Total water consumption and a breakdown over the last 10 years of the drinking water consumption for the different sectors (households, industry, agriculture, ...).
   b. Leakage management and network rehabilitation.

   Wastewater:

   c. Connection to the wastewater collecting system.
   d. Storm water management (including number of storm water overflows) and use of natural water retention measures and/or sustainable urban drainage systems (SUDS).
   e. Treatment of waste water (improvements).

   Surface and ground water:

   f. River restoration (e.g. for resurfacing rivers, naturalising previous channelled rivers)

2. Actions and measures taken by the city authorities in the last 10 years that significantly affected the trends and changes mentioned under point 1.

(max. 600 words and five graphics, images or tables)

Water consumption

Water consumption has decreased significantly over the past decade, from nearly 20 million m^3/year to slightly more than 16 million, as shown in the following table:

Water consumption over the past 10 years (2013-2022)					
	Civil and domestic use *(households)*	Civil and non-domestic use *(public places and offices)*	Agricultural and zootechnical use	Industrial use, other productive activities, other	Total
2013	12.482.564	2.564.678	8.256	4.861.972	**19.917.470**
2014	12.697.477	1.608.834	10.496	4.233.735	**18.550.542**
2015	12.453.644	2.016.193	13.478	4.729.635	**19.212.950**
2016	13.331.979	1.378.170	15.848	3.241.512	**17.967.509**
2017	16.144.055	504.386	9.450	933.139	**17.561.030**
2018	15.559.579	497.442	9.219	489.332	**16.555.572**
2019	15.800.254	507.426	7.445	528.491	**16.843.616**
2020	12.884.384	1.444.356	16.519	2.150.113	**16.495.372**
2021	12.421.328	1.123.228	17.851	2.817.266	**16.379.673**
2022	12.355.577	1.117.282	17.756	2.802.353	**16.292.968**

***Table 2**: water consumption over the past 10 years*

Since 2018, there has been a reduction in water loss levels. Concerning this issue, important activities, such as district metering (2018), have been undertaken. Districts are aqueduct areas in which the flow rate is measured to detect anomalies. The pressure is also reduced to curb the overall leakage level of the network, if possible. The project includes 34 districts: 8 (20 per cent of the network) are already in operation.

In addition, a network of acoustic sensors for real-time loss monitoring is in operation **[8]**. By analyzing the correlation between the sensors, the management system identifies the location of the leakage on the monitored sections. Since 2019, 468 fixed sensors have been installed along 138 km of the network.

Moreover, replacement work continues: since 2018, about 14 km of the network has been replaced. To this purpose, whenever possible, Trenchless Automated Leakage Repair (TARL) technology is used for such work, allowing trenchless intervention.

Results obtained in terms of hidden leaks detected from 2019 to 2023				
Start date	Area	Km	no. sensors	Total leaks detected
2019	MOMPIANO	10	38	30
2020	CENTRO STORICO	50	183	52
2021	CAIONVICO	9,6	31	8
	SANTA EUFEMIA	8,6	51	5
	URAGO MELLA	15,7	54	9
2023	BORGO TRENTO	36,9	113	2
	VIALE BORNATA-PIAVE-VENEZIA	16,8	36	0

***Table 3**: results obtained in terms of detected events of hidden leakage (2019-2023)*

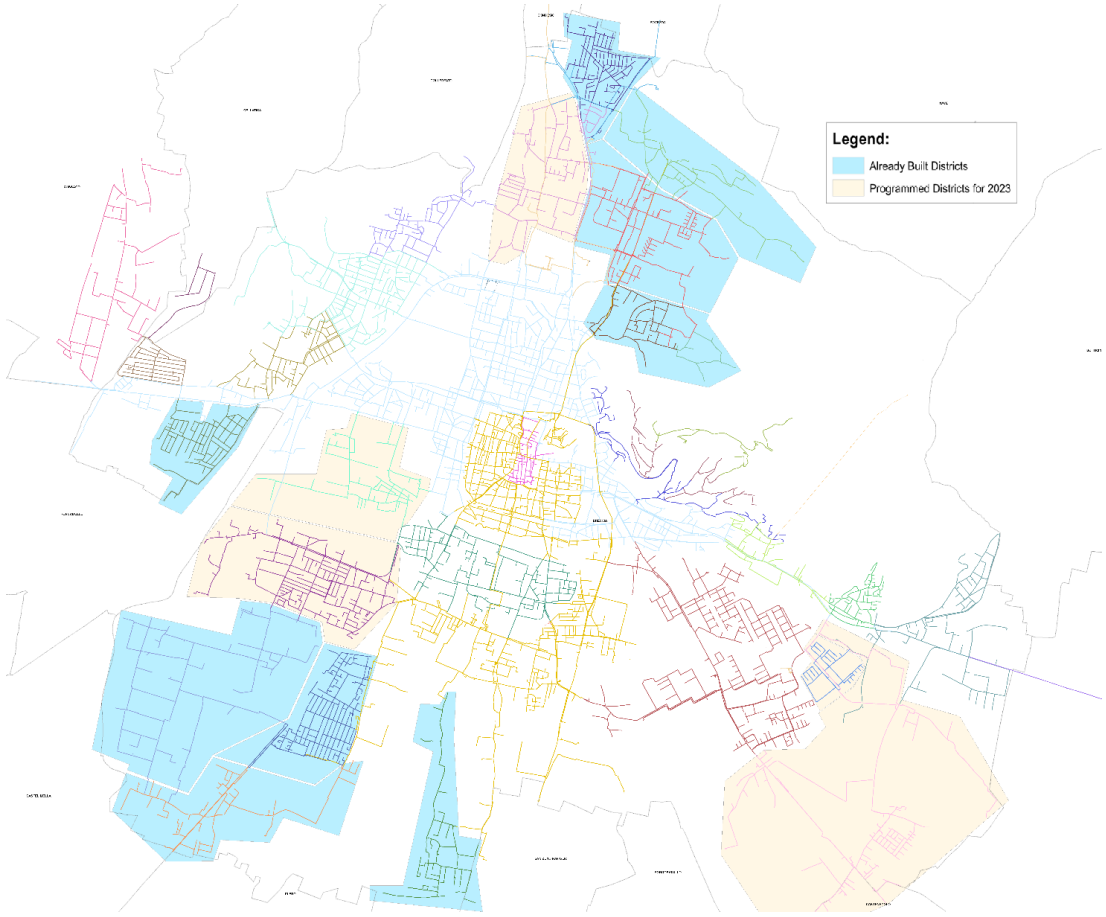

***Figura 5**: status district metering Brescia*

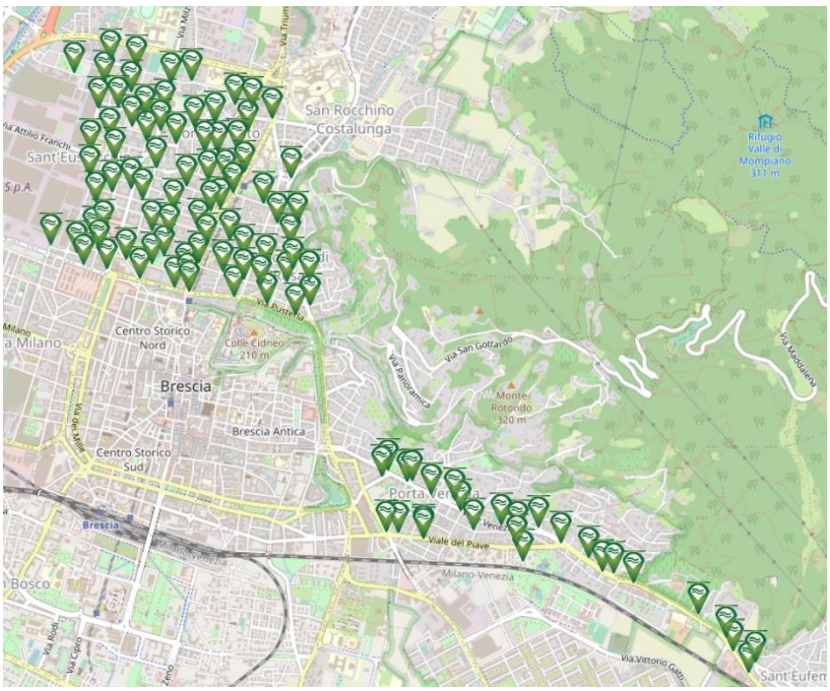

***Figure 6**: sensors positioning, city center and eastern area*

Wastewater

Over the past 8 years, the wastewater network has been extended from 547 to 557 km. The percentage of the load produced and conveyed is 95.65%; **[9]**; the remaining is conveyed through individual and/or appropriate systems.

To achieve significant treatment and energy improvements in the Verziano wastewater treatment plant, in 2012, the membrane shaking system of the MBR (Membrane BioReactor) line was updated with a monitor able to achieve 50% air reduction. In 2016, the MBR system **[10]** was renovated: the new selected membranes enabled the line's treatment capacity to be extended from 42'000 cubic meters/day to 48'000 m^3/day, increasing the plant's capacity from 250'000 inh to 296'000 inh. Also, the sludge line experienced improvements in both efficiency and optimization of the dewatering section, resulting in a reduction of sludge production.

The treatment efficiency of the plant has been on a trend of continuous improvement due to the emphasis placed on the treatment process and the provision of more reliable real-time monitoring systems.

Surface water: Parco delle Cave [11]

Until the 1980s, gravel excavation activities were dominant in the eastern part of the city. After the demise of quarry mining sites, the city administration pursued a process of restoration of the natural environment, leading to the generation of large ponds.

This process became a major challenge for the administration. Indeed, the planning choices were not limited to the greening of the lakeshore and surrounding areas; instead, they were supposed to pursue a broader goal: the reconnection of the natural elements in place. To this scope, two different projects of renaturation and enhancement of former quarries were launched. These two-year programmes resulted in the planting of about 7'500 plants, covering, with tree-shrub and new forests, an area of about 8.32 ha. On the one hand, about 11 ha were recovered and kept as lawns; on the other hand, additional 8 ha were also kept as uncultivated areas in order to encourage micro-fauna. In addition, approximately 5'500 willow cuttings and 1'000 aquatic plants were also planted.

The works, completed in October 2021 with a cost of more than 946'000 euros, resulted in the creation of three ponds and the rehabilitation of areas devoted to mining. Three basins are currently open to the public, offering cycle/pedestrian paths and birdwatching points, covering a total area of around 125 ha.

***Figure 7**. Recovery of areas occupied by gravel excavation*

2.C Future Plans

Please describe the following:

1. The objectives for 2030 and 2050 in terms of:
   a. Drinking water (incl. water saving and reuse)
   b. Wastewater treatment and management (incl. improvements in the collecting systems and in the UWWTPs). Adaptation to the requirements of the proposal for a revised UWWTD.
   c. Surface water and ground water bodies (incl. the management measures taken in order to improve bathing water quality/plans to officially identify and monitor new bathing sites, river restoration projects)
2. The planned measures to achieve the ambitions described under 1, including how they are influenced by the expected impacts from climate change and other long-term trends. Please also indicate which innovative approaches your city is planning to use and keep in mind the new targets from the Commission on water quality [1].
3. To what extent measures and ambitions described under 1 and 2 are supported by:
   a. strategic and policy commitments
   b. budget and resource allocations
   c. plans for monitoring of impacts
   d. participatory approaches
4. Current or outstanding ongoing environmental legal proceedings, including infringements regarding the relevant EU legal frameworks on Water. If there are, please indicate how and when you are planning to comply.

(max. 600 words and five graphics, images or tables)

[1] https://environment.ec.europa.eu/news/zero-pollution-ec-proposes-rules-cleaner-air-and-water-2022-10-26_en

Drinking water

A2A - Ciclo Idrico has launched a program to support the reduction of leakages aimed at achieving the highest class defined by the Italian regulatory system. The plan envisages:

- Realization of 34 districts;
- Start of active monitoring: digital twin combining modelling, district metering and workforce management;
- Installation of acoustic sensors for real-time leakage detection;
- network replacement by prioritizing actions through algorithms on historical, spatial and structural data;
- massive replacement of flow meters with smart meters;
- research of non-measured and not allowed consumption.

Information on the proper use of water aimed at reducing consumption has also been included in billing documents.

Wastewater treatment and management

The Verziano treatment plant **[12]** will be revamped by 2045 with the aim of increasing the treatment capacity to the potential of 400'000 inh, focusing on functional and environmental aspects. The new plant, using the final filtration and ultraviolet disinfection sections, will allow water suitable for agricultural reuse to be reintroduced into the environment. The sludge line developed will ensure high-quality features of the solid residues produced, ease of disposal as well as maximization of recovery of material and energy. In particular, the anaerobic digestion process followed by thermal hydrolysis sludge treatment will increase energy self-production from biogas and reduce the amount of dewatered sludge to be sent to the next stage of thermal drying. In addition, a pyrolysis process of the dried sludge is planned in order to produce renewable energy. The output product will be characterized by properties suitable for possible applications both in agriculture (soil conditioner) and industry (absorbing material, insulation materials).

Finally, to move toward net zero consumption, a ground photovoltaic system is envisaged at the detention basins with about 1 MW peak power in self-consumption at the treatment plant.

Surface water remediation

In December 2022, the Valtrompia inter-municipal sewage treatment plant went into operation (Figure 8). It is intended to treat the majority of Valtrompia's civil wastewater, improving the water quality of the Mella River, the principal stream crossing the city of Brescia **[13]**.

When fully operational, the plant will have an initial treatment capacity of 85'000 inh., with a possible extension up to 138'000 inh.

Groundwater remediation

The territory of the Municipality of Brescia shows environmental focal points as a result of historical high-impact industries (chemical, metallurgical, etc.) settled in the area during the early twentieth century. In addition, the municipality also suffers from the consequences of proximity to other high-impact industrial areas (Trompia Valley).

The groundwater, mainly in the city's industrial area located to the west, suffers from significant concentrations of Mercury, Polychlorobiphenyls (PCBs), Trichloromethane, Carbon Tetrachloride, Arsenic, and Hexavalent Chromium, principally generated by the activity of the Caffaro chemical plant located within the municipal area.

Given the extent of the problem, the Ministry of Environment has set up the Brescia-Caffaro Polluted Site of National Interest **[14] [15]**.

Safety and remediation measures for the main sources of groundwater pollution will soon be implemented and in particular: executive planning and implementation of the decommissioning, remediation and permanent safety at the Caffaro plant in Brescia (BS) (Figure 8), envisaging an investment of about 90 million euros **[16]**.

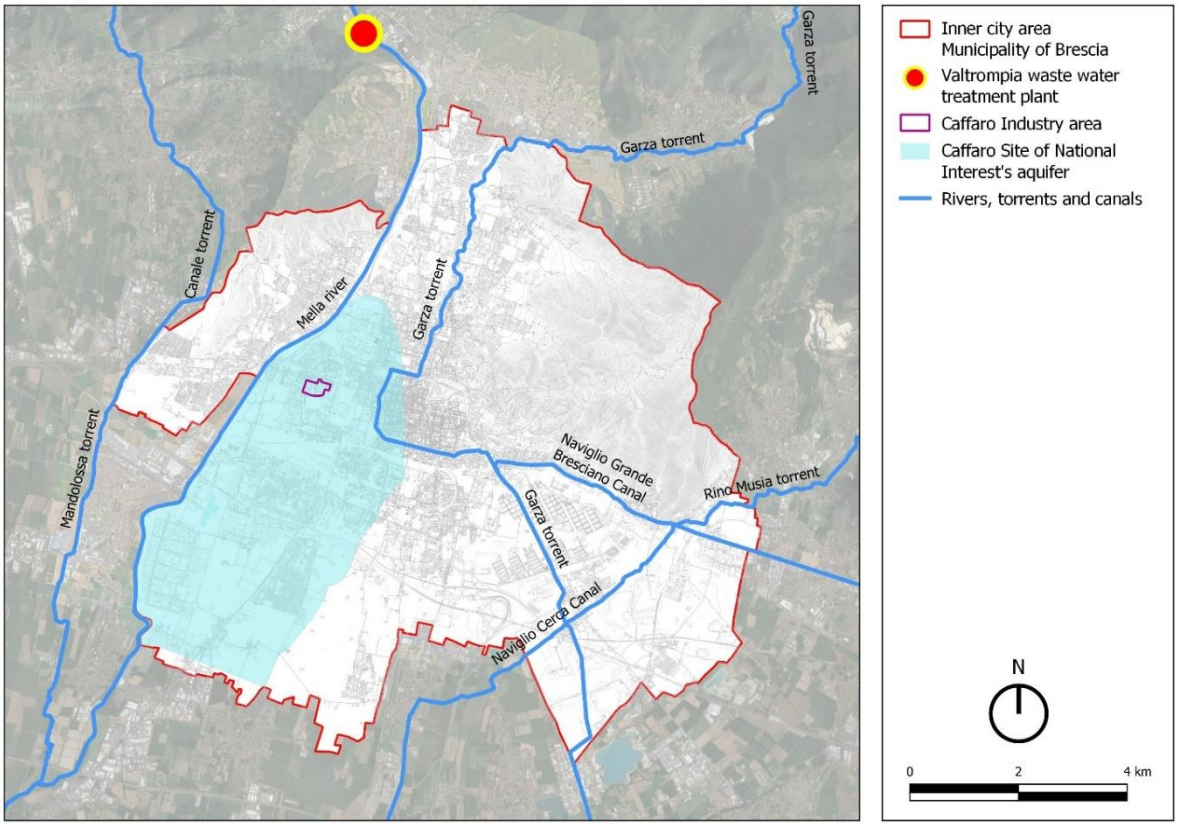

Figure 8: *Caffaro National Interest Site and the Valtrompia wastewater treatment plant*

The Brescia agglomeration is subject to the European infringement procedure 2017/2181 **[17]** concerning areas that do not have adequate wastewater collection and treatment systems. The agglomeration has acted to improve this situation, to the point that with a note dated 01/08/2022 the Lombardy Region informed the competent Ministry that it had achieved structural compliance with Directive 91/271/EEC. The final procedure to extinguish the infringement is underway.

2.D References

List supporting documentation, adding links where possible. Further detail may be requested during the pre-selection phase. Documentation should not be forwarded at thisstage.

(max. 400 words)

[1] Regulatory Authority for Energy Networks and Environment (ARERA): Regulation of the technical quality of the integrated water service or of each of its individual services (RQTI) https://www.arera.it/it/docs/17/917-17.htm

[2] Municipality of Brescia: Observatory 'Acqua Bene Comune' https://www.comune.brescia.it/aree-tematiche/ambiente/osservatori/osservatorio-acqua-bene-comune

[3] Giovanna Grossi, Francesca Barisani, Arianna Dada, Francesca Berteni, Stefano Barontini, Roberto Ranzi (2022). Sustainable water resources management, control and consumption in a changing climate: participatory research initiatives in Brescia. In: Proceedings of the 39th IAHR World Congress (Granada, 2022). Granada, 19-24/06/2022, doi: 10.3850/IAHR-39WC2521711920221537

[4] Agency for Environmental Protection (ARPA Lombardy): Stato delle acque superficiali Bacino del Fiume Oglio Rapporto sessennale 2014-2019." https://www.arpalombardia.it/sites/DocumentCenter/Documents/Stato%20delle%20acque%20superficiali%20-%202014-2019/4_Relazione%20sullo%20Stato%20dei%20Corsi%20d%E2%80%99Acqua%20sessennio%202014-2019-Oglio.pdf

[5] Agency for Environmental Protection (ARPA Lombardy): Stato delle acque sotterranee in Regione Lombardia Rapporto sessennale 2014-2019 - Giugno 2021 https://www.arpalombardia.it/sites/DocumentCenter/Documents/Stato%20delle%20acque%20sotterranee%20-%202014-2019/Relazione-sullo-Stato-delle-Acque-sotterranne-2014-2019.pdf

[6] A2A ciclo idrico: More information on the waste treatment plant of Verziano https://www.gruppoa2a.it/it/chi-siamo/nostri-impianti/idrico/depuratore-verziano https://www.google.com/search?q=impianto+depurazione+Verziano&rlz=1C1GCEA_enIT1027IT1028&oq=impianto+depurazione+Verziano&aqs=chrome..69i57j0i546j0i546i649j0i546.11440j0j15&sourceid=chrome&ie=UTF-8#fpstate=ive&vld=cid:4e2d698f,vid:W4SsLJy-J9E

[7] A2A ciclo idrico: optimization of consumption and the production of electricity from renewable sources

- Desander and B-line diffusers https://www.ssiaeration.com/it/
- Cogeneratore – Jenbacher https://www.innio.com/it/prodotti/jenbacher
- Membrane Linea B – Modello ZeeWeed, GE ora SUEZ https://www.waterspin.net/le-nostre-tecnologie/membrane-mbr-uf-e-mabr/membrane-zeeweed-per-applicazioni-mbr/

https://iris.unipa.it/bitstream/10447/239647/5/Report%20OssMBR%202016_07_14.pdf

[8] A2A ciclo idrico: Aquarius Project
https://www.a2acicloidrico.eu/azienda/comunicati-stampa/progetto-aquarius
https://www.comune.brescia.it/news/progetto-aquarius-avviato-brescia-il-piano-di

[9] Brescia agglomeration
https://www.aato.brescia.it/tematiche/piano-dambito/agglomerati

[10] MBR system
https://iris.unipa.it/bitstream/10447/239647/5/Report%20OssMBR%202016_07_14.pdf

[11] Municipality of Brescia: Surface water: Parco delle Cave
https://www.comune.brescia.it/aree-tematiche/verde-e-parchi/parco-delle-cave

[12] A2A ciclo idrico: Technical and economic feasibility project for the 'Verziano (Brescia) purification plant upgrading' project

[13] ASVT Depuratore della Valtrompia
https://www.asvt-spa.it/home/asvt/areaclienti/depuratore-val-trompia.html

[14] Municipality of Brescia: State of the Environment Report
https://www.comune.brescia.it/aree-tematiche/ambiente/relazione-sullo-stato-dellambiente

[15] ARPA Lombardia: Brescia - Caffaro Polluted Site of National Interest
https://www.arpalombardia.it/Pages/Bonifica/Brescia.aspx

[16] Special Commissioner Brescia - Caffaro site of national interest
http://bresciacaffaro.it/

Word Count Check

Please complete the below word count check.

Section	Number of words in graphics/images/tables	Number of words in body of text	Total number of words in graphics/ images/ tables and body of text	Max. words
2A	0	929	929	1000
2B	0	567	567	600
2C	0	590	590	600